and RVFAC in TTE (Rho = 0,53; $P = 0,002$); RVFAC measured by MSCT scan in axial view and RVFAC in TTE (Rho = 0,59; $P = 0,0006$); RVFAC measured by MSCT scan in apical 4 chambers view and RVFAC in TTE (Rho = 0,58; $P = 0,0007$); TAPSE scan measured by MSCT scan in axial view and Sa tricuspid annulus in TTE (Rho = 0,60; $P = 0,0002$); TAPSE scan measured by MSCT scan in apical 4 chambers view and Sa tricuspid annulus in TTE (Rho = 0,63; $P < 0,0001$). Assessing RV function by systematic multiparametric TTE strategy had a 50% sensibility and a 89,7% specificity to predict RVEF less than 35% in cardiac 64-MSCT scan with a 94,59% negative predictive value.
Conclusion.— We showed that TTE parameters used to assess RV function had good correlations with modern parameters derived from a standard 64-MSCT cardiac scan. A systematic multiparametric strategy in TTE had a high negative predictive value of RV dysfunction assessed by 64-MSCT cardiac scan. The prognostic value of such a strategy should be evaluated in prospective studies in different clinical issues like risk stratification before cardiac adult surgery or after a pulmonary embolism.

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Echocardiographic assessment of the right ventricle during inferior myocardial infarction

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Objectives.— The right ventricle infarction (RVI) may complicate 40 to 50% of inferior myocardial infarction. The purpose of this study was to evaluate the contribution of echocardiography to detect right ventricle ischemia during an inferior myocardial infarction.
Patients and methods.— This is a prospective study including all patients hospitalized for a first inferior myocardial infarction (P group) between January 2010 and November 2010. A right ventricle infarction was defined by an ST elevation of 1 mm or more in right leads (V3R, V4R). All patients underwent Doppler echocardiography during the first 48 hours and were compared to healthy subjects (S group).
Results.— The average age of our patients was 59.94 ± 13 years with a male predominance. Ten patients had electrical extension to the right ventricle (32.25%). The echocardiographic study of right ventricular function showed a significantly lower systolic function in patients than in healthy subjects (right ventricle ejection fraction: P group = 51.13%, S group= 66%, $P < 0.001$). The movement of the tricuspid annulus TAPSE was significantly lower in patients than healthy subjects (P group = 16.24 mm, S group = 21.32 mm, $P < 0.001$). Among patients, the TAPSE was significantly lower in case of RVI (RV+ = 12.22; RV− = 18.16, $P < 0.001$). Similarly, the systolic wave velocity at lateral wall of the tricuspid annulus was significantly reduced in patients compared to healthy subjects (P group = 12.13 cm/s, S group = 17.56 cm/s, $P = 0.05$), and was even lower in patients with RVI compared to the others patients (RV+ = 11.87 cm/s; RV− = 13.5 cm/s, $P < 0.001$).
Conclusion.— Our study demonstrates that the TAPSE and the systolic wave velocity at tricuspid annulus are simple methods for the early diagnosis of right ventricle ischemia during an inferior.

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Importance of challenging right side ventriculo-arterial interactions in advanced heart failure patients

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Objectives.— Pulmonary hypertension (PH) and right ventricular (RV) systolic dysfunction are two prognostic factors in advanced heart failure (AdHF). RV and pulmonary artery coupling is one of logical protocols. Conversely, RV contractile reserve response during such pharmacological challenges has not been described. Our study compared RV contractile reserve during isolated inhaled nitric oxyde (iNO) challenge or comprehensive pharmacological test with diuretics, nitrates and positive inotropes in AdHF patients (pts) addressed for PH reversibility testing.
Methods.— All AdHF pts addressed in our institution for PH reversibility testing from November, 2009 till July, 2010 were screened. We included after informed consent every pts with a mean pulmonary arterial pressure (PAP) ≥ 25 mmHg. iNO testing was performed after basal measurements, followed by a comprehensive pharmacological test after 15 minutes of wash-out. RV systolic function was assessed at each step from transthoracic echocardiography with TAPSE and the maximal velocity of the systolic wave of tricuspid annulus in tissue doppler (Sa). Contractile reserve was defined as the difference between post-test TAPSE or Sa and basal or post-wash out TAPSE or Sa (ΔTAPSE, ΔSa).
Results.— Nineteen pts were included. Mean left ventricular ejection fraction was $22 \pm 3\%$. Mean PAP was 40 ± 6 mmHg; pulmonary vascular resistances (PVR) were 4 ± 2 Wood Units. TAPSE was 14 ± 5 mm, Sa was 10 ± 3 cm/s. iNO had no significant effect on both PAP and PVR, and RV systolic function. Comprehensive pharmacological testing showed a significant decrease in mean PAP (−38.1%, $P < 0.001$), PVR (−39.6%, $P = 0.03$), and a significant RV contractile reserve (TAPSE: +22%, $P = 0.004$; Sa: +12%, $P = 0.03$). In a subgroup of 11 pts with basal Sa ≤ 10 cm/s, PAP and PVR at baseline were not different from the whole population of the study, and iNO did not reverse PH but led to a significant RV contractile reserve (ΔTAPSE: $+2.5 \pm 2$ mm; ΔSa: $+1 \pm 0.05$ cm/s). ΔSa with iNO was correlated with Δsystolic PAP ($r = -0.619$, $P = 0.04$) and Δ transpulmonary pressure gradient ($r = -0.533$, $P < 0.05$).
Conclusion.— As previously described by our team, isolated iNO challenge fails to prove PH reversibility in AdHF pts. However, iNO induces a significant RV contractile reserve in pts with the more altered RV, which is correlated to PAP and PVR decrease. These findings underline the importance of targeting ventriculo-arterial interaction in RV failure in AdHF, particularly in the more severe pts.

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Assessing right ventricular systolic function in a population of unselected patients before cardiac surgery: A multiparametric approach is mandatory

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Background and aim.— Assessment of right ventricular (RV) function is of prognostic value in patients undergoing cardiac surgery. In recent American guidelines, 2 definitions for the diagnosis of RV dysfunction are validated: (1) peak systolic velocity during ejection period (Sa) < 10 cm/s (2) RV fractional shortening (RVFS) < 35%. The aim of our study was to assess these recent recommendations in a large non-selected cohort of patients awaiting cardiac surgery.
Methods.— Two hundred and sixty seven patients (means values of age and LVEF respectively: 69 years [33—88] and 64% [10—89]) were enrolled of which 49% were awaiting coronary artery bypass grafting and 51% valve surgery. Conventional Echocardiography was performed in all. In addition, RVFS, Sa and RV Tei index were assessed. RVFS was obtained from an apical 4-chamber view focused on the RV by tracing RV endocardium in systole and in diastole. Sa as a simple and reproducible indice was recorded by pulsed-wave tissue Doppler in an apical 4-chamber view on a narrowed sector of the tricuspid annulus and the basal RV free wall in order to obtain the highest systolic velocity. RV Tei index was obtained by the pulsed-wave tissue Doppler method in an apical 4-chamber view. The Doppler sam-

ple was placed on the tricuspid annulus and Tei index was defined as the ratio of isovolumic time divided by ejection time. Three groups were obtained. A ''normal RV function'' group (RVFS > 35% and Sa > 10 cm/s), an RV dysfunction group with one abnormal criterion (RVFS < 35% or Sa < 10 cm/s) and the last group defined by 2 abnormal criteria (RVFS < 35% and Sa < 10 cm/s).
Results.— According to the normal reference values of RVFS and Sa we found 218 patients with normal RV and 49 failing RV (18% of the population): 10 patients (4%) had ''RV dysfunction'' based on Sa < 10 cm/s, 29 patients (11%) had only RVFS < 35% while 17 patients (6%) fulfilled both criteria. Mean Tei index was 0.447 ± 0.01 in the normal RV function group, 0.558 ± 0.05 in the RV dysfunction group defined by 1 criterion, and 0.679 ± 0.07 in the RV dysfunction group defined by 2 criteria (all $P < 0.05$).
Conclusions.— Applying recent guidelines (RVFS < 35% or Sa < 10 cm/s or both), we found an important discrepancy in the prevalence of RV dysfunction in a large population before cardiac surgery, ranging from 4 to 18%. Therefore, the use of both measurements (Sa and RVFS) in a systematic way appears as the most accurate way of diagnosing RV dysfunction. Furthermore, our data using the RV Tei index suggest that the presence of two pathological criteria is associated with more severe RV dysfunction than when only one pathological criterion is present.

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Phenotype of patients with pulmonary hypertension as a complication of dilated cardiomyopathy

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Background.— Because pulmonary hypertension (PH) seriously worsens prognosis of patients with EF < 35%, new drugs are currently being tested to improve hemodynamic and outcomes. The purpose of this work is to establish the prevalence and determinants of PH in an echo core lab.
Methods.— Between 01/01/2009 and 31/12/2009, all patients scanned in our echo core lab were divided into 2 groups on the basis of EF and then dichotomized based on the tricuspid regurgitation velocity (TRV > 3m/s, i.e. high prevalence of PH). In the subset group of patients with EF < 35%, we randomly selected 97 patients for left ventricular systolic and diastolic function measurement, mitral regurgitation quantification, left atrial volume calculation as well as TRV and right ventricular function assessment.
Results.— From 5658 echocardiography studies, 731 patients (13%) had EF < 35%. Among these 731 patients, TRV was undetectable in 34%, < 3m/s in 38% and > 3m/s in 28% of patients. Of the 97 patients carefully investigated, left atrial area ($p < 0.0001$), E velocity ($p < 0.0001$), A velocity ($p = 0.0004$), E/A ratio ($p < 0.0001$), S longitudinal velocity at mitral valve level ($p = 0.007$), E/E' ratio ($p < 0.0001$), mitral regurgitation severity ($p < 0.0001$) and left ventricular pre-ejection time ($p = 0.0002$) were univarietely but not independently correlated to TRV. Left ventricular dimensions and EF were not correlated to TVR. From multiple regression analysis, the 2 residual determinants of TVR were left atrial area ($p = 0.02$) and mitral regurgitation severity ($p = 0.02$).
Conclusion.— Pulmonary hypertension is prevalent in patients with EF < 35%. Both mitral regurgitation severity and left atrial dilation were the strongest determinants of pulmonary hypertension. They should be considered in the future for specific therapeutic approach.

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2D speckle tracking analysis of right atrium in patients with pulmonary hypertension

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Purpose.— Right atrial (RA) strain (ε, %) analysis by two-dimensional speckle tracking (2DST) may represent a new tool to evaluate RA function. The aim of our study was to analyze RA ε in a population of patients with idiopathic or associated pulmonary arterial hypertension (PAH) and to correlate its value with other echocardiographic parameters of RA and right ventricular function.
Methods.— Twenty-five subjects (age = 49,4 years; gr1 = 12 healthy, gr2 = 13 with PAH) underwent a complete echocardiography with estimation of systolic pulmonary artery pressure by maximal tricuspid regurgitation (TR max) velocity, measurements of RA surface, TAPSE, RV myocardial performance index (RV MPI) and maximal S velocity in the basal RV free wall (S max) with pulsed DTI. We used 2DST to measure RA ε from cine loops centered on the RA free wall. The cycle reference point was set at the beginning of the P wave, which enabled the measurement of peak negative ε (neg ε), representative of RA contractile function, and peak positive ε (pos ε), corresponding to RA conduit function. As the software automatically divided the walls in 3 different segments, we used the mean of those 3 values for analysis. RA total strain was calculated as the sum of absolute values of pos ε + neg ε and is considered as representative of RA reservoir function. All measurements were averaged on at least 3 consecutive cycles. Spearman's correlations coefficients between RA ε values and other echographic parameters were calculated. Results: There was no significant difference for neg ε (gr1 = -23.75 ± 11.24 vs gr2 = -20.22 ± 5.93, $P = 0.331$) between both groups, but pos ε and tot ε were significantly different (pos ε: gr1 = 31.99 ± 17.22 vs gr2 = 17.45 ± 11.19, $P = 0.019$; tot ε: gr1 = 55.74 ± 11.09: vs gr2 = 37.67 ± 14.13: $P = 0.002$), as were also TR max, TAPSE, RV MPI, S max and RA surface. There were no correlation between ε neg and any other echographic parameter. Both pos ε and tot ε were significantly correlated with TR max (respectively $r = 0.585$ $P = 0.004$; $r = 0.725$, $P = 0.001$), TAPSE (respectively $r = -0.530$, $P = 0.006$; $r = -0.660$, $P = \sim 0.001$), S max (respectively $r = -0.535$, $P = 0.006$; $r = -0.663$ $P = \sim 0.001$) and RA surface (respectively $r = 0.352$, $P = 0.08$; $r = 0.504$, $P = 0.01$).
Conclusions.— The 2DST derived strain is a new tool for RA function assessment. RA conduit and reservoir functions are impaired in patients with PAH but contractile function remains preserved. This is probably an adaptative phenomenon of RA to increased RV preload and decreased RV function induced by PAH as suggested by the correlation of RA strain with TR max, RA area and other echocardiographic parameters of RV function.

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